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IS 13217 (1991): Thermoplastics fumigation covers [PCD 13: Rubber and Rubber Products]

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Indian Standard

THERMOPLASTICS FUMIGATION COVERS

UDC 621·796·8 : 678·073 - 41 : 632·934·2 : 664·724

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Price Group 4

Coated Fabrics Sectional Committee, PCD 16

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Coated Fabrics Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

Fumigation covers made of double texture rubberized fabrics (DTR) are covered in IS 4810 : 1968. This is primarily a construction oriented standard, although the Committee had felt the need for inclusion of fumigant retention property performance test in due course when developed.

Through usage of DTR covers, over the years, some of the major users have observed certain shortcomings namely, their heavy weight leading to handling problems, lack of a performance evaluation of the fumigation efficiency, long fumigation cycle, and some others. A need was, therefore, expressed for exploring alternate thermoplastics covers which should mitigate these shortcomings and result in eventual cost reduction. As a first step the Committee, therefore, evolved a method of test for determining fumigation retention properties which was published as Amendment No. 3 to IS 4810 : 1968.

In the quest for alternate fumigation covers, made of thermoplastics, a number of thermoplastics as laminate or co-extrudates were suggested. These were initially screened along with the DTR covers for their fumigant retention properties. Those conforming to fumigant retention limits initially fixed on an *ad hoc* basis at 15 percent/24 h *Max* were evaluated simultaneously for determining their actual fumigant retention limits with different fumigants at the laboratories of DRDE, Gwalior and also for the deterioration in physico-chemical properties after fumigation at the laboratories of DMSRDE, Kanpur. This data has been used to fix specification limits realistically for fumigant properties and also to determine the compatibility of different thermoplastics candidate materials with different fumigants. It was found that the proposed alternate thermoplastics are not compatible with all fumigants particularly EDBR and EDCT. However, the problem was self-resolving as these fumigants are currently not in use.

Separately prospective alternate thermoplastic covers were also subjected to actual field trials for fumigation purposes in the godowns of FCI at various stations. Since several thermoplastics combinations were found to be suitable as far as the fumigation retention properties are considered, none of them possessed all the advantages which the users were seeking (*loc cit*). The Committee, therefore, considered it expedient to formulate this standard basically for two generic types of alternate thermoplastics combinations namely, PVC supported and unsupported and polyethylene woven and coated or cross-laminated. The two basic types of alternate covers comply with the essential requirements and improved fumigant retention; weight reduction and consequent ease of handling. All of them, however, do not possess the same combination of advantages envisaged. Through use of this standard it is hoped that in due course a consensus would emerge regarding the most suitable alternate thermoplastics combination which provides the maximum performance *vs* cost benefit.

Since it is not possible to lay down a single set of requirements for two different thermoplastic materials, the requirements in this standard have been classified as type tests (product/type approval) and acceptance test (product identification). In this manner, any material proposed for fumigation covers shall be first subjected to product/type approval tests and then shall be tested for physical characteristics like tensile strength, breaking load, accelerated ageing test, etc, to prove the conformity of the material to acceptance tests. Certain acceptance tests for the two generic types of thermoplastics namely, PVC and PE are different, for example, blocking test and loss of plasticizers are of direct relevance to PVC material because due to loss of plasticizer, PVC material has a tendency to deteriorate resulting in lowering of tear strength and other physical properties whereas ply adhesion test or test for delamination are necessary requirements for PE material. Hence the flex test is more critical in case of PE material than in PVC material. Keeping in view the above mentioned observations, the Committee has decided to classify the requirements as type tests and acceptance tests.

Further it was envisaged that new thermoplastics or their combinations may in due course be available for use as fumigation covers, these new materials will have to be screened for all the type tests including fumigant retention characteristics before such materials are accommodated in the standard.

Certain desirable tests like fire resistance were considered but not stipulated since no case history of a fire hazard in fumigation, which in any case are carried out in the open, has yet been reported so far. It is hoped that in due course extensive field experience on these alternate covers would be generated on the basis of which the Committee could review the standard for reducing varities further on their own merits.

Indian Standard
THERMOPLASTICS FUMIGATION COVERS

1 SCOPE

1.1 This standard prescribes methods of sampling and test for thermoplastics fumigation covers suitable for aluminium phosphide and methyl bromide fumigants only.

1.2 These fumigation covers are not intended for use with ethylene dibromide (EDBR) and ethylene-dibromide carbon tetrachloride (EDCT) fumigants.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
2 : 1960	Rules for rounding off numerical values (*revised*)
1070 : 1977	Water for general laboratory use (*second revision*)
1964 : 1970	Methods for determination of weight per square metre and weight per linear metre of fabrics (*first revision*)
2076 : 1981	Unsupported flexible polyvinyl chloride sheeting (*first revision*)
2244 : 1972	Glossary of terms relating to treated fabrics (*first revision*)
2508 : 1984	Specification for low density polyethylene films
4810 : 1968	Fumigation sheets and covers, rubberized (with Amendments No. 1, 2 and 3)
7016	Method of test for coated and treated fabrics
7016 (Part 2) : 1981	Determination of breaking strength and extension at break
7016 (Part 4) : 1987	Resistance to damage by flexing (*first revision*)
7016 (Part 6) : 1987	Determination of bursting strength (*first revision*)
7016 (Part 7) : 1986	Determination of resistance to penetration by water (*first revision*)
7016 (Part 8) : 1975	Accelerated ageing
7016 (Part 9) : 1988	Determination of blocking resistance (*first revision*)

3 TERMINOLOGY

3.1 For the purpose of this standard, definitions given in IS 2244 : 1972 shall apply.

3.2 Type Tests

Tests carried out to prove conformity of the basic thermoplastic and its design/construction with the specification for product/type approval of a given type of thermoplastic fumigation cover.

3.3 Acceptance Tests

Tests carried out on samples taken from a lot conforming to type tests for the purpose of acceptance of the lot on a batch to batch basis.

4 TESTS

4.1 Classification of Tests

4.1.1 *Type Tests*

The following shall constitute type (product approval) tests:

a) Workmanship (*see* **5.2**),
b) Substance (*see* **5.3**),
c) Fumigation retention test (*see* **5.5**),
d) Strength of joints (*see* **5.9**), and
e) Ease of repair (*see* **5.13**).

4.1.1.1 The fumigation cover material shall be subjected to product/type approval in accordance with the details given in Annex A.

4.1.2 *Acceptance Tests*

a) Workmanship (*see* **5.2**)
b) Mass of the cover (*see* **5.4**)
c) Water proofness test (*see* **5.7**)
d) Blocking test (*see* **5.8**)
e) Flex test (*see* **5.10**)
f) Tensile strength [*see* Table 1, Sl No. (i)]
g) Breaking strength [*see* Table 1, Sl No. (ii)]
h) Bursting strength [*see* Table 1, Sl No. (iii)]
j) Accelerating ageing (*see* **5.6**)
k) Loss of plasticizer [*see* Table 1, Sl No. (iv)]

4.1.2.1 The batch shall be accepted if the fumigation cover is found to comply with the requirements of acceptance/approval identification tests given in **4.1.2**. Tests listed under **4.1.2** (d) and **4.1.2** (k) are specific to **PVC** materials only. A sampling plan for determining the acceptability or otherwise of a lot is given in Annex E.

5 REQUIREMENTS

5.1 Material

5.1.1 This standard covers the following two types of thermoplastics fumigation covers depending on the basic thermoplastics combination:

Type 1 — Unsupported/reinforced polyvinyl chloride sheeting

Type 2 — HDPE woven fabric laminated with polyethylene or cross laminated with polyethylene

5.2 Workmanship

Both Type 1 and Type 2 cover shall be examined on flat illuminated surface suitable for showing up defects. It shall be free from blisters, creases of permanent nature, cuts, pinholes and other visual defects.

5.3 Substance

Mass of given cover in grams per square metre (gsm) when determined as per IS 1964 : 1970 by taking mass of a test piece cut to a suitable size of not less than 25 × 25 cm from the sheet from which fumigation covers are made shall be as given below:

Size	gsm
Type 1	325 to 350
Type 2	195 to 220

5.4 Mass of the Cover

The mass of fumigation covers shall fall within the range specified below. Tolerance limits for mass of the cover shall be as agreed to between the buyer and the seller.

Typical Size of Cover (in ft)	*Type 1* (in kg)	*Type 2* (in kg)
(31 × 21 × 17)	76 - 82	45 - 53
(32 × 21 × 17)	77 - 83	46 - 54
(32 × 21 × 18)	82 - 88	49 - 57

5.5 Fumigation Retention Test

5.5.1 The percentage loss of aluminium phosphide fumigant shall be not more than 7·5 percent for Types 1 and 2 materials when tested as per Annex **B-1**.

5.5.2 The percentage loss of methyl bromide fumigant shall be not more than 15 percent for Type 1 and Type 2 material when tested as per Annex **B-2**.

5.6 Accelerated Ageing Test

The sample shall show no apparent deterioration like softening, stiffening, tackiness, brittleness, discoloration and degradation of physical properties, when tested for accelerated ageing as per IS 7016 (Part 8) : 1975. The tensile strength, bursting strength, and breaking strength of the aged material when tested as indicated in col 7 of Table 1 shall be within the limits specified in Table 1.

5.7 Water Proofness Test

A 20 cm diameter pieces of the sample when subjeted to a 90 cm head of water for one hour as per method given in IS 7016 (Part 7) : 1986 shall not allow water to percolate through and not become wet on its outer surface.

5.8 Strength of Joints

The joint for Type 1 and Type 2 shall be capable of withstanding a load of 2·5 kg on 2·5 cm strip for one hour when tested as per the method given in Annex C.

5.9 Blocking Test

Sample of material Type 1 shall pass the blocking test as per IS 7016 (Part 9) : 1988.

5.10 Flex Test

The sample shall pass the flex test for minimum 50 000 cycles when tested as per IS 7016 (Part 4) : 1987.

5.11 Construction of Fumigation Covers (for Type 1 and Type 2)

5.11.1 Fumigation covers shall be made by sealing together pieces of fumigation sheet material of appropriate dimensions. It shall have 3 openings at top, each fitted with a tubular funnel made from a piece of fumigation sheet material and provided with tying tapes for closing. It shall also be provided with a number of handling strips at the top and bottom. The size and other details of the design of the cover shall be as agreed to between the purchaser and the supplier.

5.12 The sample shall also comply with the requirements given in Table 1.

5.13 Ease of *in situ* Repair

It shall be responsibility of the manufacturer to provide a kit and instructions for repairing of defects/damages that may occur during usage of fumigation covers. This may be either adhesive tapes or solvent based cement as recommended by manufacturer. A trial of repairing a cut may be demonstrated by the manufacturer. In case adhesive tapes are provided for repair, the minimum adhesion of the tape to the material of the fumigation cover shall be 1·5 N per 10 mm width when tested as per Annex D.

6 SAMPLING OF FUMIGATION SHEETS

6.1 The scale of sampling and the criteria for conformity of the material shall be as prescribed in Annex E.

Table 1 Physical Requirements for Thermoplastic Fumigation Covers

(*Clause* 5.12)

Sl No.	Material	Type 1		Type 2		Methods of Test, Ref to IS No.
		Gr A	Gr B	Gr A	Gr B	
		Unsupported PVC Sheeting	Supported PVC Sheeting	Cross Laminated Polyethylene Sheeting	Polyethylene Fabric Reinforced and Coated with Polyethylene	
	Characteristic	Requirements	Requirements	Requirements	Requirements	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Tensile strength kg/cm², *Min*	—	—	—	—	—
	Original					
	Longitudinal direction	175	—	300	—	2076 : 1981 (For Type 1) 2508 : 1984 (For Type 2) 7016 (Part 8) : 1975
	Transverse direction	150	—	225	—	
	After ageing at 70±1°C for 168 h					
	Longitudinal direction Transverse direction	10% decrease from the original	—	30% decrease from the original	—	
ii)	Breaking strength, kg/5 cm, *Min*	—		—		
	Original					
	Longitudinal direction	—	25·0	—	60·0	7016 (Part 2) : 1981
	Transverse direction		15·0		50·0	
	After ageing at 70±1°C for 168 h					
	Longitudinal direction	—	10% decrease	—	20% decrease	7016 (Part 8) : 1975
	Transverse direction	—	from the original		from the original	
iii)	Bursting strength, kg/cm², *Min* *Original*	4·0	7·0	—	15·0	7016 (Part 6) : 1987
	After ageing at 70±1°C for 168 h	10% decrease from the original	10% decrease from the original		20% decrease from the original	
iv)	Loss of plasticizers, percent by mass, *Max*	4·0	4·0	—	—	

ANNEX A

(*Clause* 4.1.1)

PROCEDURE FOR PRODUCT/TYPE APPROVAL

A-1 The fumigation cover materials shall be approved if they are found to comply with the requirements as given in **4.1.1**.

A-2 Accordingly, the fumigation cover materials shall first be examined for any surface defects like pinholes and cuts, if any, and then shall be tested for gsm of the material followed by fumigant retention test. Besides the strength of seams test and ease of repair may also be carried out.

A-3 Fumigation cover materials successfully passing these type tests shall be tested for physical characteristics like tensile properties/breaking strength, water proofness, accelerated ageing, flex test and bursting strength for both PVC and PE materials. However, loss of plasticizer and blocking test may be done only for PVC materials. The value for these properties shall fall within the limits stipulated in Table 1.

A-4 In the event of any change in the basic quality of thermoplastics cover material reapproval will be required and the type tests shall be carried out a fresh and the controlling specifications for acceptance test redetermined.

A-5 When the proposed changes are such that it may not be expected to significantly affect the performance (satisfactorily passing the type tests), the certifying/testing authority may at its discretion recommend waiving complete reapproval or may require only partial reapproval in order to determine the significance and acceptability of the proposed changes and to redetermine and fix the controlling specifications for acceptance tests.

A-6 In the event of fumigation cover materials being found to be failing in one or more type tests, the testing authority may call for fresh samples not exceeding twice the number of original samples and subject them to the test(s) in which the failure has occurred. The tests may be considered to have been satisfied and product/type approval given only if in the repeat test(s) no failure occurs.

ANNEX B
(*Clause* 5.5)

DETERMINATION OF FUMIGANT RETENTION PROPERTY

B-0 GENERAL

Two methods for determination of fumigant retention property have been prescribed. Volumetric method covered under **A-1** is applicable only to aluminium phosphide fumigant whereas gas chromatographic method covered under **A-2** is applicable to both aluminium phosphide and methyl bromide fumigants.

B-1 VOLUMETRIC METHOD— DETERMINATION OF FUMIGANT RETENTION PROPERTY

B-1.0 Quality of Reagents

B-1.1 Unless specified otherwise, pure chemicals and distilled water (*see* IS 1070 : 1977) shall be used in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

B-1.2 Apparatus

B-1.2.1 *Gas-Tight Syringe* — 100-ml capacity.

B-1.2.2 *Aspirator Bottle* — 5-litre capacity bottle fitted with three-way stopcock.

B-1.2.3 *Petri Dish*

B-1.2.4 *Burette* — 50-ml capacity.

B-1.2.5 *Pipette* — 10-ml capacity.

B-1.2.6 *Exposure Cell* — A specially designed stainless steel cell comprising of two cylindrical chambers having cross section area 100 cm^2 and 10 cm height which may be coupled without leakage with the help of a silicone rubber seal (*see* Fig. 1). The test fabric is sandwiched between these two chambers and tightened with nuts and bolts. Both the cells shall have in and out vents controlled through precision needle valves for introduction and withdrawal of air for analysis.

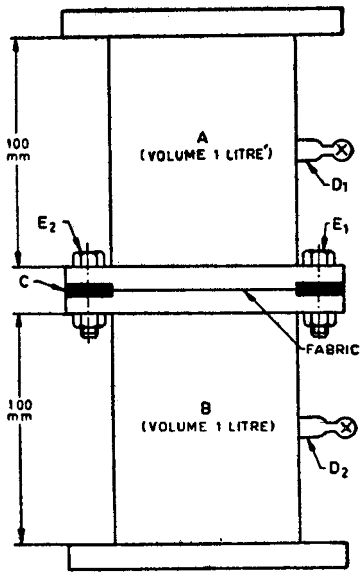
B-1.3 Reagents

B-1.3.1 *Aluminium Phosphide Tablet* — Each tablet weighing approximately 3 g and containing minimum 56 percent (*m/m*) active ingredients.

B-1.3.2 *Mercuric Chloride Solution* — 10 percent (*m/v*) solution of mercuric chloride in water.

B-1.3.3 *Standard Iodine Solution* — 0·1 N iodine solution. Dissolve 12·7 g of iodine in water containing 30 g of potassium iodide and make up the volume to 1 litre in volumetric flask.

B-1.3.4 *Standard Sodium Thiosulphate Solution* — 0·1 N sodium thiosulphate solution. Dissolve 24·8 g of sodium thiosulphate crystals ($Na_2S_2O_3.5H_2O$) in water and make up the volume to one litre in volumetric flask.



A and *B* = Stainless steel chambers
C = Silicone rubber seal
D_1, D_2 = Inlets for fumigants
E_1 and E_2 = Clamping nuts and bolts

FIG. 1 APPARATUS FOR CHECKING RETENTION OF FUMIGANTS

B-1.3.5 *Starch Indicator Solution* — Make a paste of 1 g of soluble starch with a little water. The paste is then added to 100 ml of boiling water with constant stirring. The resulting solution is boiled for another minute and then cooled.

B-1.4 Standard Atmospheric Conditions for Testing

B-1.4.1 Test shall be carried out in an atmosphere of 65 ± 5 percent relative humidity and at a temperature of 27 ± 2°C.

B-1.5 Procedure

B-1.5.1 *Estimation of Phosphine Concentration in Aspirator Bottle*

Two to three aluminium phosphide tablets are kept in aspirator bottle. The bottle is made air-tight and filled with air having relative humidity more than 60 percent. After the equilibration period of 24 h, 50 ml phosphine laden air is drawn from this bottle through a three-way stopcock into a gas-tight syringe and then slowly bubbled into 20 ml of 10 percent mercuric chloride solution. The precipitate formed is filtered, washed and then dissolved in 10 ml of 0·1 N iodine solution. Titrate this iodine solution against standard sodium thiosulphate solution using starch solution as indicator.

B-1.5.1.1 Carry out a blank by using all reagents in the same quantities except phosphine gas.

B-1.5.1.2 *Calculation*

Calculate the concentration of phosphine in enclosed space of aspirator bottle as follows:

$$\text{Phosphine, mg/l (c)} = \frac{0{\cdot}425 \times V \times N \times 1\,000}{0{\cdot}1 \times 50}$$

where

V = final volume of standard sodium thiosulphate solution in ml, used for titration of iodine solution, after correction for blank; and

N = normality of standard sodium thiosulphate solution.

Estimate the volume of phosphine required to produce a concentration of 3 mg/l in the upper chamber of apparatus as follows:

$$\text{Volume of phosphine required (ml)} = \frac{1000 \times 3}{C}$$

where

C = concentration of phosphine in mg/l (*see* **B-1.5.1.2**).

B-1.5.2 *Estimation of Escaped Phosphine*

15 ml of10 percent mercuric chloride solution is kept in a wide petri dish in the lower chamber. The test fabric is fitted in between the two chambers which are clamped tightly. The fabric shall be properly and uniformly stretched between the two chambers. The upper chamber is partially evacuated by the gas-tight syringe and required volume of air containing phosphine to produce 3 mg/l concentration, as calculated in **A-1.5.1.2** is introduced into it. After 24 h of exposure the test chambers are opened and the amount of phosphine permeated in the lower chamber (which forms precipitate with mercuric chloride solution kept in petri dish) is estimated following the procedure of dissolving precipitate in iodine solution and titrating it against standard sodium thiosulphate solution as given in **A-1.5.1**.

B-1.5.2.1 Carry out a blank by using all reagents in the same quantities except phosphine gas.

B-1.5.2.2 *Calculation*

Calculate the concentration of phosphine (mg) permeated in the lower chamber in 24 h as follows.

B-2 GAS CHROMATOGRAPHIC METHOD FOR METHYL BROMIDE

B-2.0 Outline of the Method

The permeability of methyl bromide is determined by gas chromatography. Gas chromatography offers a very convenient way of analysing fumigants taken separately or in mixture. An aspiratory bottle is thoroughly evacuated and filled with methyl bromide gas which provides a source of methyl bromide for further experimentation. The gas chromatographic procedure consists of injecting the same volume of air from upper and lower chamber and then comparing the peak areas after 24 h of exposure. This procedure does not require any calibration. However, it is difficult to account for the quantity of fumigant observed on cell walls or that which interacts irreversibly with sample. Nevertheless this method provides an adequate way of assessing the suitability of material as fumigant covers.

B-2.1 Apparatus

B-2.2.1 Any suitable gas chromatograph may be used. The chromatographic conditions given below are for guidance only:

Column	*Stainless Steel*
a) Length	2 m
b) Stationary phase	5% carbowax 20 m on celite
c) Column temperature	100°C
d) Flow rate	60 ml/minute
Detector	
Detector temperature	158°C

B-2.2 Procedure

The apparatus as shown in Fig. 1 is used for determination of permeation of methyl bromide. The required volume of methyl bromide to give desired concentration of 22 mg/ litre, is withdrawn from first aspiratory bottle and introduced into lower chamber of permeation cell using a gas tight syringe. Then 0·5 ml of air is injected in both the lower and upper chamber. The quantity of gas in the two chambers is compared by determining the peak areas after 24 h of exposure.

B-2.3 Calculation

The percentage permeation is calculated using the following relationship:

$$\text{Permeation} = \frac{\text{Peak area in upper chamber}}{\text{Peak area in upper chamber} + \text{Peak area in lower chamber}}$$

$$\text{Concentration of phosphine, mg } (Z) = \frac{0{\cdot}425 \times V \times N}{0{\cdot}1}$$

where

V = final volume of standard sodium thiosulphate solution in ml, used for titration of iodine solution after correction for blank; and

N = normality of standard sodium thiosulphate solution.

Calculate the percentage of escaped phosphine in 24 h as follows:

$$\text{Escaped phosphine, percent} = \frac{Z \times 100}{3}$$

where

Z = concentration of phosphine, in mg, permeated in lower chamber (*see* **B-1.5.2.2**).

ANNEX C

(*Clause* 5.8)

DETERMINATION OF STRENGTH OF SEAMS

C-0 OUTLINE OF THE METHOD

C-0.1 This test is carried out by applying the load to the test piece for a specified time after fixing the same in a grip.

C-1 APPARATUS

C-1.1 The apparatus consists of two grips capable of accommodating test piece 25 mm in width for welded seams, a suitable stand, a weight support and a series of weights capable of being fitted to the weight support (*see* Fig. 2).

C-1.1.1 Laboratory screw clips of 40 mm width constitute suitable grips for this test. Means shall be provided for attaching them to the stand and the weight support in such a manner that the tension is uniformly applied to the test specimen.

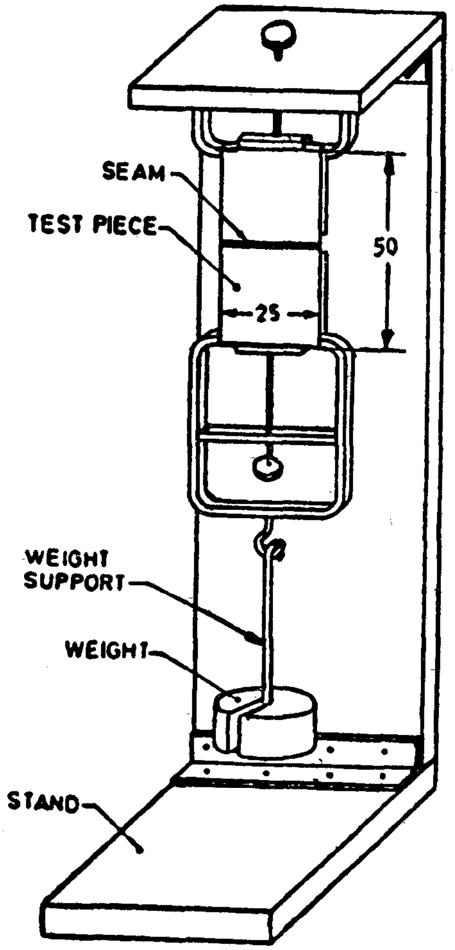
C-2 PREPARATION OF TEST SPECIMENS

C-2.1 For Welded Seams

A test piece 25 mm wide and approximately 100 mm in length shall be cut at right angles to the direction of the weld in such a manner that the seam is equidistant from each end of the test piece. At least three test pieces shall be cut from each weld.

C-3 PROCEDURE

C-3.1 Mount the test piece in the grips so that the grips are 50 mm apart with the seam equidistant and parallel to each grip. Suspend one grip from the stand and attach to the other grip of the weight carrier. Add the weights to the weight carrier so that the total load applied plus the weight of the carrier is that specified in 5 10 but taking precautions that no tension is applied to the test piece until all the weights have been attached to it. Then release slowly the weight carrier over a period of approximately 2 minutes and leave suspended for a total period of 60 minutes from the time of first applying the load.



All dimensions in millimetres.

FIG. 2 APPARATUS FOR SEAM STRENGTH TEST

C-4 REPORT

The material shall be taken to have passed the test if welding/sealing at the joints remains unchanged after withstanding the specified load for the specified time.

ANNEX D

(*Clause* 5.13)

DETERMINATION OF EASE OF REPAIR OF COVER BY ADHESIVE TAPE

D-0 OUTLINE OF THE METHOD

D-0.1 Ease of repair of fumigation cover by adhesive tape shall be determined by finding the force required to peel a strip of tape from the surface on which it is applied at a specified angle and speed.

D-1 PROCEDURE

D-1.1 Cut a specimen of 10 × 25 cm size from the fumigation cover material provided for testing. Clean the surface of specimen with a clean piece of untreated tissue paper, cotton wool or cotton cloth. Apply 30 cm of the adhesive tape of minimum 3 cm width on the specimen in the manner that tape lies centrally on the specimen extending beyond the specimen to be accommodated in the testing equipment.

D-1.2 Place the roller centrally across the test specimen, once in each direction at constant speed of approximately 30 cm/min ensuring that no air bubble is trapped between the tape and the specimen.

Fold the free end of the tape at an angle 180° and peel off 3 cm from the specimen leaving 22 cm in contact. Clamp the specimen in the lower jaw of tensile testing machine (a pendulum or spring balance type). Attach the free end of tape to the head of the tension measuring device and disengage the pawls, if any. Start the tensile testing machine taking reading at 2 cm intervals when the tape is pulled from specimen. Disregard the first 5 cm and last 3 cm. The load required to cause the separation of the tape from the specimen shall be reported in N/cm. The mean of 5 readings shall give the result. If the tape breaks during the test, report the test on another set of test specimens.

ANNEX E

(*Clause* 6.1)

SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

E-1 LOT

In any consignment, all the rolls of thermoplastic sheets of the same type, colour and finish shell be grouped together and each such group shall constitute a lot.

E-1.1 The conformity of the lot to the requirements of the specification shall be ascertained for each lot separately. The number of rolls *N* to be selected from a lot shall depend on the size of the lot *n* and shall be in accordance with Table 2.

Table 2 Number of Rolls of Sheets to be Selected for Sampling

Lot Size *N*	Number of Rolls to be Selected *n*
Up to 50	2
51 to 100	3
101 to 200	4
201 to 300	5
301 and above	7

E-1.2 The rolls of sheets shall be selected at random and to ensure the randomness of selection, random number tables shall be used. In case such tables are not available, the following procedure may be adopted subject to agreement between the purchaser and the supplier:

> Arrange all the rolls in the lot in a systematic manner and starting from any roll, count them as 1, 2, 3......etc, up to *r* and so on, where *r* being the integral part of *N*/*n* (*N* being the lot size and *n* the sample size). Every *r*th roll thus counted shall be withdrawn till the requisite number of rolls is obtained.

E-1.3 Number of Tests

E-1.3.1 From each of the rolls selected according to **5.1.2**, one-metre length of thermoplastic sheet shall be cut, care being taken to exclude not less than 0·25 metre length of the material from either end. The test specimens necessary for the various tests specified in the standard shall be cut from the length of thermoplastic fumigation sheet thus obtained.

E-1.3.2 All the type tests shall be conducted on each test specimen cut from these metre lengths as obtained in **E-1.3.1**. Only after successful type approval, acceptance tests shall be carried out.

E-1.3.3 In case each test specimen passes all the type tests as per **4.1.1,** the material in the lot shall then be tested for acceptance test as per **4.1.2**. For this purpose test specimens of suitable length may be taken.

E-1.3.4 Strength of welded joints may be tested on a piece cut out from actual fumigation covers.

E-1.4 Criteria for Conformity

E-1.4.1 The lot shall be declared as conforming to the requirements as given in **4.1.1** if all the test specimen passes all the type tests (*see* Annex A, **A-6**).

E-1.4.2 The lot having being found satisfactory as per **E-1.4.1** will be declared as conforming to the requirements of the specification, if all the test specimen passes all the acceptance tests.

E-1.4.3 If the specimens taken from these lengths fail in one or more acceptance tests, each such test shall be repeated twice. For this purpose, two further metre lengths shall be cut from the same roll as the failing metre length and specimens shall be cut from each of them so that duplicate tests may be conducted in respect of each failure. If all samples pass in the re-test the lot shall be declared as conforming to the specification, otherwise not.

E-2 SAMPLING OF FUMIGATION COVERS

E-2.1 Lot

All the fumigation covers produced from essentially similar materials by the same manufacturer shall be grouped together to constitute a lot.

E-2.2 Each lot shall be inspected separately for the requirements of this specification. For this purpose from each lot a number of covers shall be selected at random in accordance with col 1 and 2 of Table 3.

E-2.2.1 The number of covers required in col 2 of Table 3 shall be taken equally from as many bales as possible. The covers to be taken from a bale shall be chosen at random.

Table 3 Scale of Sampling of Finished Covers
(*Clauses* E-2.2 *and* E-2.2.1)

No. of Covers in the Lot (1)	No. of Covers to be Inspected (2)	Permissible No. of Defectives (3)	No. of Covers to be Tested (4)
Up to 100	13	1	1
101 to 300	20	2	2
301 and above	32	3	3

E-3 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

E-3.1 Each one of the covers selected for inspection shall be examined for visual defects if any and for construction requirements laid down by the buyer. A cover failing in one or more of these requirements shall be regarded as defective.

E-3.2 Mass of each cover selected for test shall fall within the range specified in **4.5**. However, the buyer if he so desires may check each cover purchased for mass.

E-3.3 The fumigation covers selected for test shall be tested for all the requirements specified in **4**. The lot shall be declared to be in conformity with these requirements if each of these cover satisfies all the requirements.

NOTE — If the buyer so desires the portion of the cover from where the sample has been cut out for the test, shall be mended by the manufacturer.

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.